BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PCT/GB 99/00393
09/601810

REC'D 14 APR 1999
WIPO PCT

The Patent Office

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP9 1RH

GB 99/00393

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

5

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed K A Richards

Dated 26 FEB 1999

Patents Form 1/77

Pa[redacted]ct 1977
([redacted])

THE PATENT OFFICE
D
-9 FEB [redacted]98
LONDON

The Patent Office

[redacted]

11FEB98 E337055-1 C03008
P01/7700 25.00 - 9802753.5

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference — AF-57209 — 09 FEB 1998 — **9802753.5**

2. Patent application number
(The Patent Office will fill in this part)

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

AYRSHIRE METAL PRODUCTS PLC
Irvine
Ayrshire KA12 8PH
Scotland

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — 7375504001

4. Title of the invention

MODULAR BUILDING UNIT

5. Name of your agent *(if you have one)*

LLOYD WISE, TREGEAR & CO.

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Commonwealth House
1-19 New Oxford Street
London WC1A 1LW

Patents ADP number *(if you know it)* — 117001 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES.

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	10
Claim(s)	4
Abstract	-
Drawing(s)	3 + 3

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature LLOYD WISE, TREGEAR & CO. Date 09.02.1998

12. Name and daytime telephone number of person to contact in the United Kingdom

MISS ALICE FINDLAY
(0171) 571 6200

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.

b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) For details of the fee and ways to pay please contact the Patent Office.

MODULAR BUILDING UNIT

This invention relates to building construction and in particular to modular units for use in construction of buildings such as hotels, motels and hospitals.

Traditional building materials include bricks, concrete and cement. Timber is of course another traditional building material and buildings have been constructed using a timber frame work erected from panels formed by interconnected struts and cross-members.

Steel is another known building material which has been used to provide a framework for building units. Such units comprise rectangular parallelepiped steel frames formed from heavy duty structural members which support the floor and roof joists and wall studs.

Of recent years lightweight steel has been used for many applications in place of more traditional building materials. The known timber framework technology has been adopted with the panels formed from lightweight steel sections and comprising a frame of joists with cross runners, the frame being strengthened by lateral and/or diagonal bracing. Panels of similar construction but in other necessary shapes are also provided and the panels are transported to the intended location of the building. A floor is laid down first and the panels are then erected and connected on site to construct the building.

Lightweight steel framing systems have a number of advantages. The first of these is the use of steel as a construction material. Steel, while having a relatively high embodied energy content, is nevertheless a realistic incombustible structural alternative to wood. The use of

steel also responds to the call by environmental organisations to minimise the use of wood in construction. Steel is 100% recyclable and has no material downgrading when recycled. There is little waste in its production and fabrication.

A further advantage of lightweight steel framing systems is that construction time can be reduced in comparison for example to constructions of brick and mortar. However on-site erection and interconnection of the panels is required and finishing of the building units including fitting of floor, roof and wall sheeting as well as decoration can only be done on site.

It is an object of the present invention to provide a unit module for a building which reduces the on-site construction time. It is a further object to provide such a unit which can be delivered to site in a fitted-out state.

It is a further object of the present invention to provide a building unit module which minimises the amount of steel required and is capable of fast construction whilst still being strong and robust.

It is a still further object of the present invention to provide a building unit module which can be formed at any desired length, width and height.

A building unit module in accordance with the invention comprises a lattice framework formed of a plurality of parallel spaced rectangular frame members and multiple parallel runners each extending transversely and

connected to at least two adjacent frame members, and, sheeting attached to the runners to form an enclosure defined exteriorally by the lattice framework.

The module is three-dimensional whereas the units of known lightweight steel framing systems are two-dimensional. This has a number of advantages. Firstly the amount of construction work on site is reduced as the need for erection and connection of individual panels of known lightweight steel framing systems is done away with. Furthermore the module can be fitted out off site which allows production line techniques for fit-out and reduces the amount of materials and manpower required on site.

It has been found that the combination of the rectangular frame members, runners and sheeting produces a robust and strong structure more than capable of functioning as a room of a building. It is noted here that although the frame members are described as "rectangular", deviations from true rectangular shape are possible depending on desired room configuration.

The dimensions of the module can be simply varied by varying the number and/or dimensions of the frame members. This means that the module is very versatile and usable in a large number of different types of building.

In a preferred embodiment the frame members are spaced along the length of the module and the runners extend along that length. The runners are furring runners of "top hat" section.

The frame members of the preferred embodiment each

comprises four interconnected frame sections, with four butt welded joists of C-shaped cross-section being particularly preferred.

The lattice framework may include a corner member connected between each of the adjacent corners of at least two adjacent frame members. Preferably however each corner member extends across and is connected to all the frame members at corresponding corners thereof. The corner members may be angle members of structural steel and may be provided internally and externally of the framework.

The ends of the modules may be provided with plural parallel cross runners extending widthwise and connected to the end most frame members. The ends of the module can therefore be closed off by securing wall sheeting to the cross runners.

The cross runners may mount a window frame at one end of the module and a door at the other end of the module. Alternatively or additionally window frames may be mounted in the main runners as to may be door frames.

Very preferably the lattice framework is formed of light gauge steel structural sections. Thus the advantages of steel as a construction material is employed in the module whilst still making the module relatively light. The use of lightweight steel allows the module to be transported via trailer to the proposed building site and manoeuvred into position simply and safely.

Plural modules may be used to form a building in

which the modules are stacked one atop the other and/or positioned side by side and interconnected by connecting the lattice framework of each module to the lattice framework(s) of the or each adjacent module(s).

The invention also provides a method of constructing a building unit module comprising forming plural rectangular frame members, positioning the frame members vertically in an aligned row with a first predetermined spacing between each adjacent pair of frame members, connecting multiple horizontal runners to the frame members with the horizontal runners parallel to each other and with a second predetermined spacing between each adjacent pair of runners to form a lattice framework, and, securing sheeting to the lattice framework via the runners to form an enclosure.

To provide the preferred embodiment module, the method correspondingly preferably includes securing horizontal angle members to the four internal and four external corners of the lattice framework and carrying out the frame member formation step by butt welding four structural sections.

The invention will now be further described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a building unit module in accordance with the invention;

Figure 2 is a side view of the module of Figure 1,

and,

Figure 3 is a perspective view of three modules as shown in Figure 1 connected together in use.

The module shown in Figures 1 and 2 comprises a series of rectangular frame members 4 which are termed hereinafter "ribs". The ribs 4 are made from standard structural steel sections, preferably stud joist sections, butt welded together. The length of the four stud joist sections forming each rib 4 determines the cross-sectional dimensions of the module 2. The length of the module 2 is determined by the number of ribs 4 used.

The ribs 4 are positioned vertically at a first predetermined spacing in two spaced jigs. Preferably one jig is fixed whilst the other is movable to accommodate ribs 4 of different width.

The ribs 4 are connected by a series of horizontally positioned runners 6 which run the full length of the module 2. The runners 6 are spaced at a second predetermined spacing and welded to the ribs 4 to create a lattice beam structure.

The ribs 4 are preferably themselves constructed by butt welding four lightweight structural steel sections together. Preferably four stud joist sections are employed which may be of C-shaped cross-section with lipped flanges to give an overall open mouth box configuration. The runners 6 are also preferably lightweight steel structural sections and most suitably top hat sections. With the preferred forms, the arms of the top hat sections runners 6 are

welded to the webs of the box sections of the ribs 4.

The module 2 additionally includes four steel angles 10 which run the full length of the module assembly and are welded to the four internal corners as well as a further four steel angles 12 which again run the full length of the module 2 but are welded to the four external corners.

The module is completed by laying floor decking on the whole of the floor area which is secured to the bottom members of the ribs 4, preferably by self-drilling, self-tapping screws. Roof decking is secured in a similar manner to the top members of the ribs 4. The module 2 is then completed by fitment of internal walls and external end panels.

Figure 3 illustrates three modules 2 with those on the left in the sense of the Figure fitted with floor and roof decking 14. As Figure 3 illustrates the modules 2 can be stacked one on top of each other and/or side by side to form a building.

The basic form of a module 2 can be modified in a number of ways. A module 2 may include a door frame 14 in one or more of the walls as illustrated in Figure 1 as well as one or more window frames. The door and window frames are also preferably formed by joists which are welded to the adjacent ribs 4 and runners 6.

Another possible variation is to provide a "cut-out" from the overall rectangular shape of the module 2 which will act as a service duct. A cut-out is illustrated in

the left-hand most corner of the module 2 of Figure 1.

As illustrated, the runners 6 extend along the side walls of the module 2. Short lateral bracing runners 17 are preferably provided in the roof and floor of a module 2 to stop twisting of the floor and roof rib members. Cross runners 18 extend across the ends of the module 2 to allow the ends to be closed off with wall sheeting.

The module 2, by virtue of its formation from lightweight structural steel sections, can be lifted and transported to a building site by trailer. For this purpose the upper external angle members 12 have lifting plates 20 welded thereto.

In the preferred form, as discussed above, the ribs are formed from four stud joist sections which are open mouth box sections. Other common sections can be used but preferred are the stud joist sections produced by the Applicants and described in their brochure Ayrshire Steel Framing. The preferred stud joist sections have cross-sectional dimensions ranging from 40 mm x 70 mm to 40 mm x 340 mm and have the advantage that they are asymmetrical with unequal flange sizes and so may be nested together to form a closed box for use at concentrated load points.

The first predetermined spacing, between the ribs 4, is suitably 400 mm but may be between 100 mm and 600 mm. In practice the spacing may be set by the dimensions of the floor decking, the distance between the ribs 4 being adjusted according to decking size to produce a floor of desired stiffness.

The second predetermined spacing, between the runners 6, is preferably 500 mm but may be between 300 mm and 600 mm. In practice again the spacing may be determined by the dimensions of the sheeting panels used on the walls of the module 2, in this case to give a desired wall stiffness. Standard panel sizes are 600 x 2400 mm.

The module 2 may have overall dimensions of 3m x 4m by 8m to allow two modules 2 to be transported on a standard trailer. However as will be appreciated the dimensions can be varied simply by varying the size and number of the ribs 4.

Many types of roof and floor decking are known as well as sheeting suitable for attachment to the walls of the module 2. Currently preferred for use are Cement Bonded Particle Board (CBPB); Plywood; and Chipboard and Glass Reinforced Cement (GRC) as the decking and Plasterboard; CBPB and GRC as the wall sheetings.

On site, plural modules 2 are positioned on to concrete pad or steel beam foundations 22 as illustrated by Figure 3. They are joined one to another either with plates at the conjunction of four modules 2 and/or by connection with corridor floor frame assemblies. The modules 2 may be physically connected to the foundations but this is not always necessary.

The welding of the components of the module 2 may be metal inert gas (MIG) welding although other known types of welding can be used.

The modules 2 can be fitted out prior to delivery to site. A particular advantage of the module 2 is that the walls, floor and ceiling are particularly flat which is important when furniture is to be fitted.

The modules 2 are suitable for use in construction of any building which has a cellular or repetitive type layout with vertical alignment of load bearing walls.

CLAIMS

1. A building unit module comprising a lattice framework formed of a plurality of parallel spaced rectangular frame members and multiple parallel runners each extending transversely and connected to at least two adjacent frame members, and, sheeting attached to the runners to form an enclosure defined exteriorally by the lattice framework.

2. A building unit module as claimed in Claim 1 wherein the frame members are spaced along the length of the module and the runners extend along that length.

3. A building unit module as claimed in either Claim 1 or Claim 2 wherein the runners are furring runners of top hat section.

4. A building unit module as claimed in any preceding Claim wherein each frame member comprises four interconnected frame sections.

5. A building unit module as claimed in Claim 4 wherein each frame member comprises four butt welded joists of C-shaped cross-section.

6. A building unit module as claimed in any preceding Claim wherein the lattice framework includes a corner

member connected between each of the adjacent corners of at least two adjacent frame members.

7. A building unit module as claimed in Claim 6 wherein each corner member extends across and is connected to all the frame members at corresponding corners thereof.

8. A building unit module as claimed in either Claim 6 or Claim 7 wherein the corner members are angle members.

9. A building unit module as claimed in any one of Claims 6 to 8 wherein the corner members are provided both internally and externally of the framework.

10. A building unit module as claimed in any preceding Claim including plural parallel cross runners extending widthwise and connected to the endmost frame members.

11. A building unit module as claimed in any preceding Claim wherein the lattice framework is formed of light gauge steel structural sections.

12. A building comprising a plurality of modules as claimed in any preceding Claim stacked one atop the other and/or side by side and interconnected by connecting the lattice framework of each module to the lattice framework(s) of the or each adjacent module(s).

13. A method of constructing a building unit module comprising forming plural rectangular frame members, positioning the frame members vertically in an aligned row with a first predetermined spacing between each adjacent pair of frame members, connecting multiple horizontal runners to the frame members with the horizontal runners parallel to each other and with a second predetermined spacing between each adjacent pair or runners to form a lattice framework, and, securing sheeting to the lattice framework via the runners as to form an enclosure.

14. A method as claimed in Claim 13 additionally comprising securing horizontal angle members to the internal corners of the lattice framework.

15. A method as claimed in either Claim 13 or Claim 14 additionally comprising securing horizontally angle members to the four external corners of the lattice framework.

16. A method as claimed in any one of Claims 13 to 15 wherein the frame member formation step is carried out by butt welding four structural sections together.

17. A building unit module substantially as hereinbefore described and illustrated in the accompanying drawings.

18. A method of constructing a building unit module substantially as hereinbefore described and illustrated in the accompanying drawings.

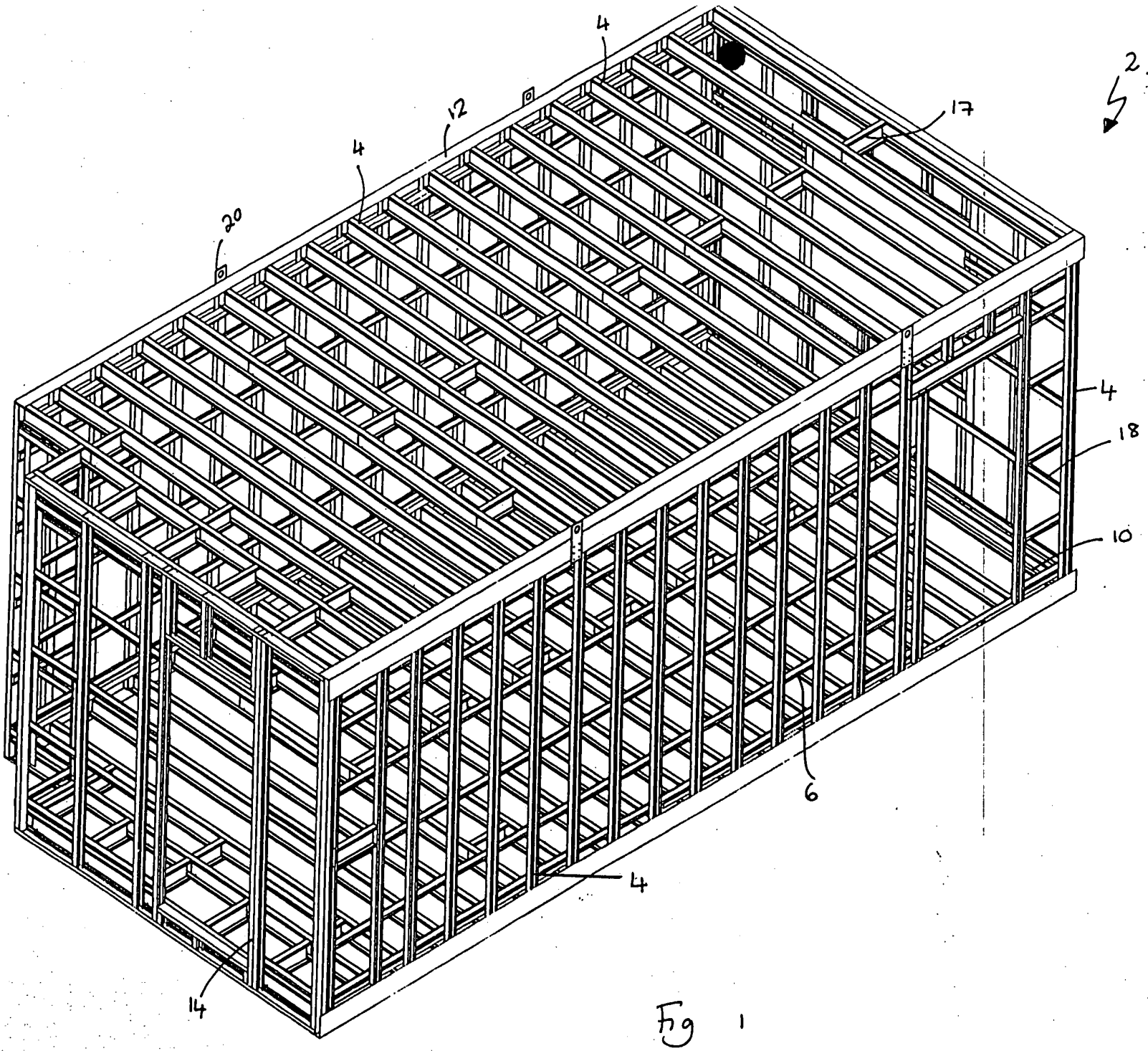

Fig 1

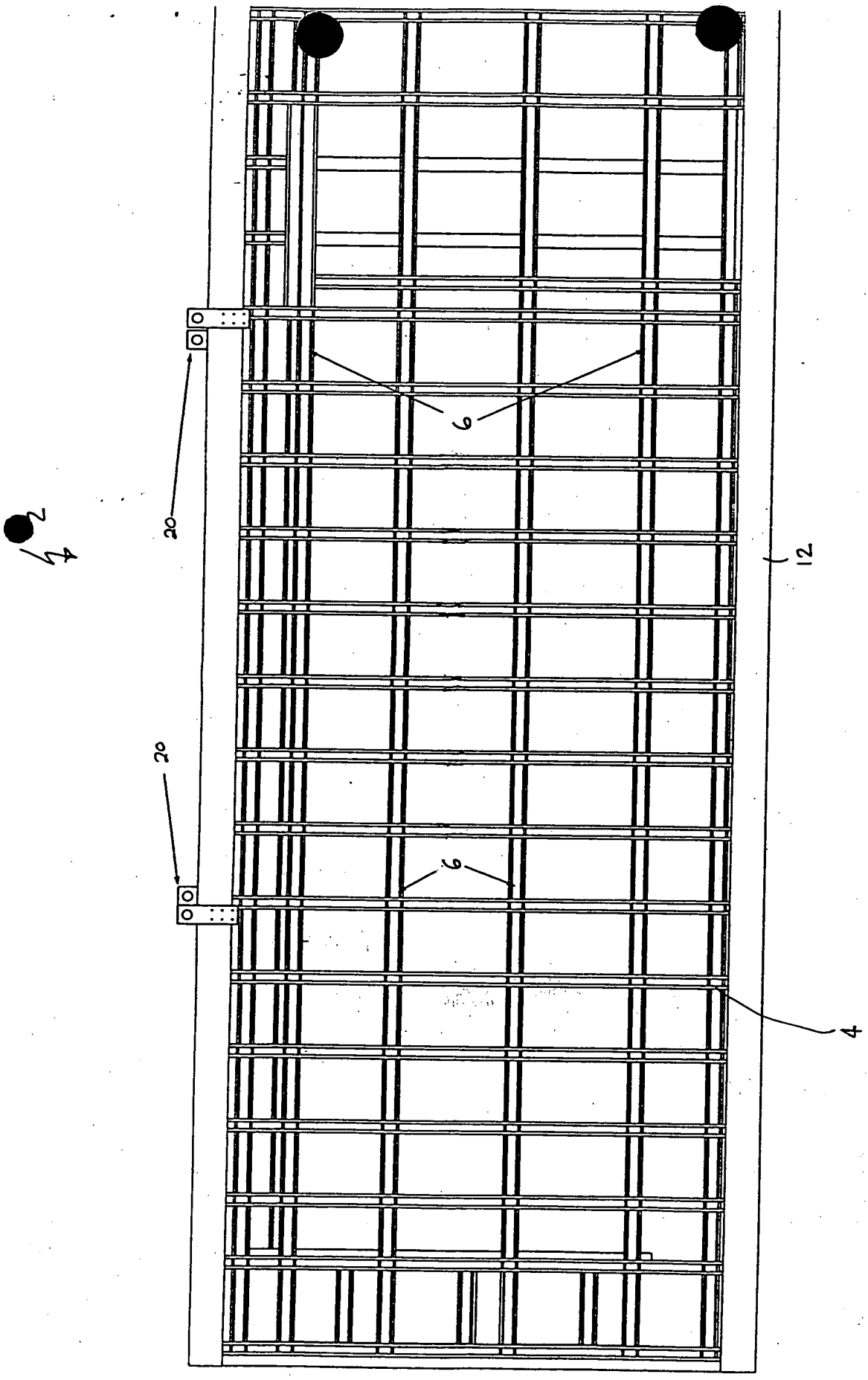

Fig 2

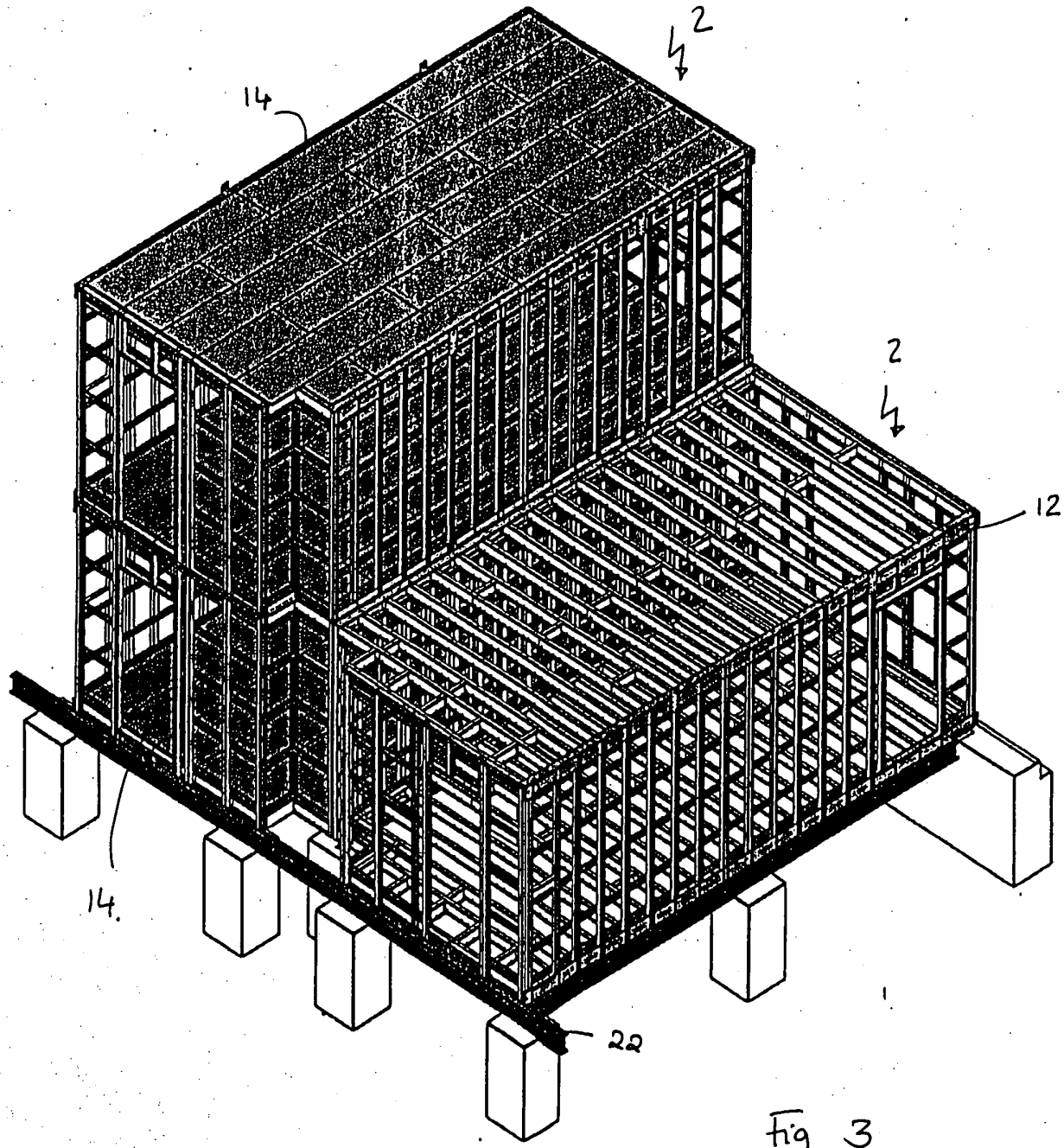

Fig 3

PCT/GB99/00393
9802753.5
Lloyd Wise Tregear & Co
8.2.99